CLAIMS

1. A machine for performing machining operations on a work-piece comprising:

a carriage;

a robotic arm mounted on said carriage, said arm having a movable head containing a tool for performing the machining operations on the work-piece;

a laser position determination system for determining the actual spatial relationship of said carriage and said work-piece and providing a first signal representative thereof and further determining the spatial relationship of said head to the work-piece during actual machining operations on the work-piece and providing a second signal representative thereof;

a computer having a computer program providing a third signal to said robotic arm for machining the work-piece based on a predetermined spatial relationship between said carriage and the work-piece and for receiving said first and second signals and adjusting said third signal based on the actual spatial relationship between said carriage and the work-piece prior to machining operations and said head and the work-piece during machining operations.

2. The machine as set forth in claim 1 wherein said carriage is portable.

3. The machine as set forth in claim 2 wherein said laser position determination system includes:

a laser transceiver system;

at least one first laser target mounted on said carriage;

at least one second laser target mounted on the work-piece; and

at least on laser target mounted on said head

4. The machine as set forth in claim 3 wherein the carriage includes means to lock the machine in a position in proximity to the work-piece.

5. The machine as set forth in claim 4 wherein said laser position determination system includes a single laser transceiver assembly adapted to track said at least one first, second and third laser target.

6. The machine as set forth in claim 1, or 2, or 3, or 4, wherein said laser determination system for determining the actual spatial relationship of the work-piece during the machining operations.

7. The machine as set forth in claim 6 wherein said laser transceiver system comprises:

a first laser transceiver assembly for tracking said at least one target mounted on said carriage;

a second laser transceiver assembly for tracking said at least one laser target mounted on the work-piece; and

a third laser transceiver assembly for tracking said at least one laser target mounted on said head.

8. The machine as set forth in claim 4 wherein said laser transceiver system comprises:

a first laser transceiver assembly for tracking said at least one target mounted on said carriage and said carriage; and

a second laser transceiver assembly for tracking said at least one laser target mounted on the work-piece.

9. A computer controlled machine for performing machining operations, on a work-piece, the machine having a carriage with a movable head containing a tool for performing the machining operations on the work-piece, the computer having a computer program for providing first signals to the head for controlling the movement thereof to specific spatial relationships with the work-piece so that the tool can perform the machining operations, the machine comprising:

a laser position determination system for determining the actual spatial relationship of the carriage to work-piece; and to continuously determine the spatial relationship of the head during the performance of machining operations and providing a second signal indicative of the actual position; and

the computer program adapted to compare said second signal to the first signal and to adjust the first signal so that the head is positioned to the specific spatial relationships.

10. The machine as set forth in claim 9 wherein the carriage is portable.

11. The machine as set forth in claim 10 wherein said laser position determination system includes:

a laser transceiver system;

at least one first laser target mounted on the machine;

at least one laser target mounted on the work-piece; and

at least one laser target is mounted on the head.

12. The machine as set forth in claim 11 wherein said carriage includes means to lock the machine in a position in proximity to the work-piece.

13. The machine as set forth in claim 9, or 10, or 11, or 12 wherein:

said laser position system also determines the spatial relationship of work-piece during machining operations and provides a third signal representative thereof; and

the computer program adapted to also compare said third signal to the first signal and to adjust the first signal.

14. A method of increasing the accuracy of a machine for performing machining operations on a work-piece, the machine having a carriage with a robotic arm, the robotic arm having a head containing a tool for performing the machining operations on the work-piece, the head movable to a computed spatial relationships to the work-piece directed by a first signal from the computer based on a predetermined spatial relationship between the carriage and work-piece, the method comprising the steps of:

determining the actual spatial relationship between the carriage and work-piece prior to machining operations and providing a second signal representative thereof;

continuously determining the actual spatial relationship between the head and work-piece during the performance of machining operations and providing a third signal indicative of the actual spatial relationship therebetween; and

adjusting the first signal based on the difference between the first and signal and the second and third signals such that head remains in the computed spatial relationships to the work-piece.

15. The method as set forth in claim 14, including the step of determining the actual spatial relationship between the carriage and of the work-piece during machining operations and providing a fourth signal representative thereof; and during the step of additionally adjusting the first signal based on the difference between the first and forth signals such that the head remains in the computed spatial relationships to the work-piece continuously accomplished during machiningoperations.

16. The method as set forth in claim 15 wherein said steps of determining the actual spatial relationship between the carriage and work-piece and providing a second signal representative thereof and continuously determining the actual spatial relationship between the head and work-piece during the performance of machining operations and providing a third signal indicative of the actual position, and the step of additionally adjusting the first signal based on the difference between the first and forth signals such that the head remains in the computed spatial relationships to the work-piece continuously accomplished during machining operations are accomplished by means of a laser position determination system.

17. A machine for performing machining operations on a work-piece comprising:

a portable carriage;

a robotic arm mounted on said carriage, said robotic arm having a head for mounting a tool for machining the work-piece;

a laser position determination system comprising:

at least one first laser target mounted on said work-piece;

at least one second laser target mounted on said carriage;

at least one third laser target mounted on said head; and

a laser transceiver for determining the spatial relationship of said carriage, work-piece, and said head during machining operations, respectively, and to provide output signals representative thereof; and

a computer having a first part of a computer program for machining the work-piece with said tool based on a preset spatial relationship between said carriage and the work-piece, said computer having a second part of said computer program adapted to adjust said first part of the said computer program in response to said output signals such that said head is properly positioned during the machining operations should said work-piece or said robotic arm introduce positional errors.

18. A machine for performing machining operations on a work-piece comprising:

a portable carriage;

a robotic arm mounted on said carriage, said robotic arm having a head for mounting a tool for machining the work-piece;

a laser position determination system comprising:

at least one first laser target mounted on said work-piece;

at least one second laser target mounted on said carriage;

at least one third laser target mounted on said head; and

first, second and third laser transceiver assemblies for directing laser beams at said first, second and third at least one targets respectively and to provide first, second and third signals representative of spatial relationship of said carriage, work-piece, and said head during machining operations, respectively; and

a computer having a first part of a computer program for machining the work-piece with said tool based on a preset spatial relationship between said carriage and the work-piece, said computer having a second part of said computer program adapted to adjust said first part of the said computer program in response to said first, second and third signals such that said head is properly positioned during the machining operations should said work-piece or or said robotic arm introduce positional errors.

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